

# Richmond Refinery LPS Bulletin – Reliability

## TK-1400 Thrust Probe Failures (RLOP SD)



Impact ERM: 36434

### Location:

Richmond Refinery – RLOP  
TK-1400 H2 Recycle  
Compressor Turbine

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### Reference:

Investigation #22505



Photo of Thrust End  
of TK-1400

### Tenets of Operations Violated:

**Tenet #1-Operate within  
design and environmental  
limits**

**Tenet #3-Ensure safety  
devices in place and  
functioning**

**Tenet #8-Address abnormal  
conditions**

### Incident Description:

At 9pm on April 25, 2012, operations noticed that the TK-1400 thrust probes readings were drifting toward danger levels. Operations reduced the machinery speed from 9700 rpm to the minimum speed of 7900 rpm at 11:46pm. However, the thrust indication which was drifting toward the trip setting did not stop or reverse direction. The machine tripped at 12:35 am on the T1 thrust position. HNC shutdown and was depressurized to the relief system per emergency procedures, resulting in a flaring event and loss of production.

### Investigation Findings:

- 1) The conduit routing used for the thrust probe cables had an excessive number of 90° elbows without intermediate pull boxes. This caused the cables and connectors to be damaged when they were pulled into the conduit during installation.
- 2) There was initial undetected damage during installation, which over time caused drifting indications from the axial probe as compared to the true position leading to the eventual turbine trip.
- 3) The abnormal readings from thrust probes had been detected weeks before the shutdown. Wiring was checked 36 hours prior to the trip and adjusted so that the signal appeared to return to normal but without correcting the conduit routing issues the repair was unsuccessful. The readings began to drift very soon after completion.
- 4) Although the thrust channel output was questionable and other machinery condition indicators provided contradicting information, the vibration system was not bypassed until the accuracy of the thrust channels could be corrected and verified.

### Lessons Learned / Business Practices:

- 1) Proper design practices and reviews must be followed so that the conduit is properly routed to prevent damage when pulling wires.
- 2) Properly identifying and correcting root causes is critical to completing proper repairs when issues are identified in critical machinery instrumentation/shutdown systems.

### Recommendations:

- 1) Modify the TK-1400 thrust channel conduit between turbine and driver enclosure so as to allow cable installation without damage to cables.
- 2) Reinforce the use of the existing procedure for installing vibration probes on rotating equipment ([RR-517-P-7202](#)). This procedure includes direction to avoid a similar failure in future installations.

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